

ECON 222A

Macroeconomic Theory I

Exchange Rates, Business Cycles,
and Macroeconomic Policy
in the Open Economy
Lecture 18

Today's Lecture

- PS4 is due on April 1st .
- Class on April 8th only exercises.

Today's Lecture

- Some Open Economy Concepts
- How Exchange Rates Are Determined
- The International Asset Market

Open Economy Considerations

- Extend the analysis to include foreign sector to understand international trade, financial markets and exchange rates.
- Crucial as most economies are now linked.
- Important relationship between interest rates, r , and exchange rates, e through asset markets.

Open Economy Considerations

- Two aspects of the interdependence of the world economies:
 - international trade in goods and services;
 - worldwide integration of financial markets.
- Fiscal and Monetary policies are going to have different outcomes, because of the international relationships.

Exchange Rates

- Nominal: e_{nom}
 - How many units of a foreign currency can I get with one unit of the domestic currency?
- Real: e
 - How many units of a foreign good can I get in exchange for one unit of a domestic good?

Nominal Exchange Rates

- Currencies: US dollar, Canadian dollar, Japanese Yen, British pounds, Euro...
 - the rate at which one currency can be traded for another is the nominal exchange rate
 - so this rate is like a 'price', and the amount of currency is like 'supply'
 - They are traded in the foreign exchange market

Exchange Rate Regimes

- Past: Fixed exchange rate system
 - rate set at officially determined levels
 - international gold standard system (1800's, early 1990's)
 - fixed currency in terms of gold value
 - Bretton Woods system (1944)
 - fixed currency in terms of the US
- Present: floating exchange rate system
 - market for currency freely determines the rate

Exchange Rate Regimes

- Fixed exchange rate system: value determined by the government
- Floating exchange rate system: value determined by supply and demand conditions in the foreign exchange market

Appreciation and Depreciation

Type of Exchange Rate System	Exchange rate <i>increases</i> “stronger”	Exchange rate <i>decreases</i> “weaker”
<i>Flexible</i> exchange rates	Appreciation	Depreciation
<i>Fixed</i> exchange rates	Revaluation	Devaluation

Real Exchange Rate

- Suppose nominal exchange rate for Canada-Japan is: 1 dollar = 78 yen
 - great: go to Japan and you're rich
 - not really...
- We need to account for cost of living
 - hamburgers: 312 yen in Tokyo, \$3 in Toucan
 - so $312/78 = \$4$ Canadian
 - so Toucan burger is $\frac{3}{4}$ price of Tokyo burger

Real Exchange Rate

- The relative price of goods between two Countries
 - 0.75 hamburgers is the real exchange rate
- Components
 - $e_{nom} = (78 \text{ yen}) / (1 \text{ dollar})$
 - $P_{For} = (312 \text{ yen}) / (1 \text{ burger})$
 - $P = (3 \text{ dollars}) / (1 \text{ burger})$

Real Exchange Rate

- *RER* is the number of units of foreign goods that can be obtained in exchange for one unit of the domestic good:

$$e = \frac{e_{\text{nom}} P}{P_{\text{For}}}$$

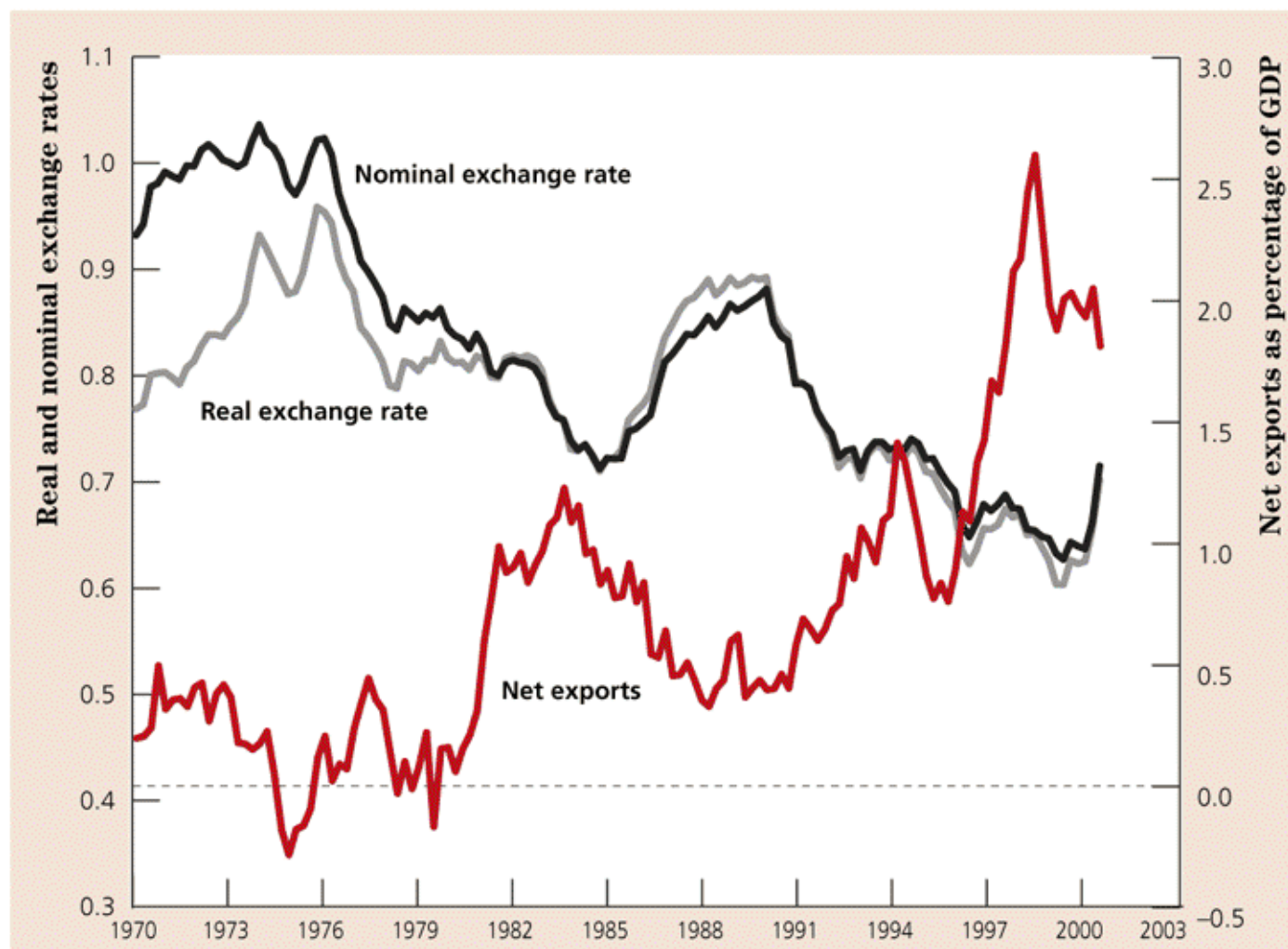
- P_{For} = the price of foreign goods, measured in the foreign currency
- P = the price of domestic goods, measured in the domestic currency

FIGURE 10.1

**CANADA-US REAL AND
NOMINAL EXCHANGE
RATES AND NET
EXPORTS, 1970-2003**

Canadian net exports to the United States are measured on the right vertical axis and the Canada-US real and nominal exchange rates are measured on the left vertical axis. Note that the nominal and real exchange rates tend to move together. Note also that net exports rise when the real exchange rate falls.

Source: Adapted from the following: Net exports to the US in millions of dollars, seasonally adjusted, quarterly: CANSIM II series v114387. Canadian GDP in millions of dollars, seasonally adjusted, quarterly: CANSIM II series v498086. Nominal Canada-US exchange rate, quarterly: CANSIM II series v37426. Real Canada-US exchange rate calculated using Canadian GDP implicit price deflator (CANSIM II series v498086/v1992259) and US GDP implicit price deflator (CANSIM II series v122054/v149258).



Real Exchange Rate

- With many goods, prices measured with indexes/“baskets” (e.g. CPI, GDP deflator)
- “Effective” exchange rates weigh countries by trade importance

Purchasing Power Parity

- Purchasing Power Parity (PPP): similar foreign and domestic goods (or baskets of goods) should have the same price when expressed in the same currency ($e=1$).
- Ignores transportation and transactions costs.

Purchasing Power Parity

- The PPP implies that:

$$e_{nom} = \frac{P_{For}}{P}$$

- Empirical evidence: PPP holds in the very long run, but not in the short run.

Purchasing Power Parity

- Rewrite e in growth rates to get an identity:

$$\frac{\Delta e}{e} = \frac{\Delta e_{nom}}{e_{nom}} + \frac{\Delta P}{P} - \frac{\Delta P_{For}}{P_{For}}$$

- Or:

$$\frac{\Delta e_{nom}}{e_{nom}} = \frac{\Delta e}{e} + \pi_{For} - \pi$$

- And when e is constant we get the Relative purchasing power parity (works well for high-inflation countries).

$$\frac{\Delta e_{nom}}{e_{nom}} = \pi_{For} - \pi$$

Nominal Exchange Rates

- The equation in growth terms says that the percentage change in the nominal exchange rate depends on the growth of the RER and the difference in the inflation rates between countries
- Nominal appreciation occurs if:
 - the real exchange rate grows
 - domestic inflation is less than foreign inflation

The Real Exchange Rate and Net Exports

- The real exchange rate:
 - represents the rate at which domestic goods can be traded for foreign goods;
 - affects a country's net export.
- The higher the real exchange rate is, the lower a country's net exports will be.

The Real Exchange Rate and Net Exports

- Real appreciation lowers net exports
- An increase in e means that domestic goods can buy more foreign goods (domestic goods become more expensive)
- Domestically: switch to foreign goods, or an increase in M
- Foreigners: switch away from our goods , or a decrease in X

$$\downarrow \downarrow NX = \downarrow X - \uparrow M$$

How Exchange Rates are Determined

- Not surprisingly it's supply and demand
 - Supply = Canadians
 - Demand = Foreigners
- We focus on e_{nom}
 - note that: $e = e_{nom}(P/P_{For})$
 - so for P and P_{For} that grow at similar rates, focusing on e only is ok
- e_{nom} is the value of a currency, which is determined in a market

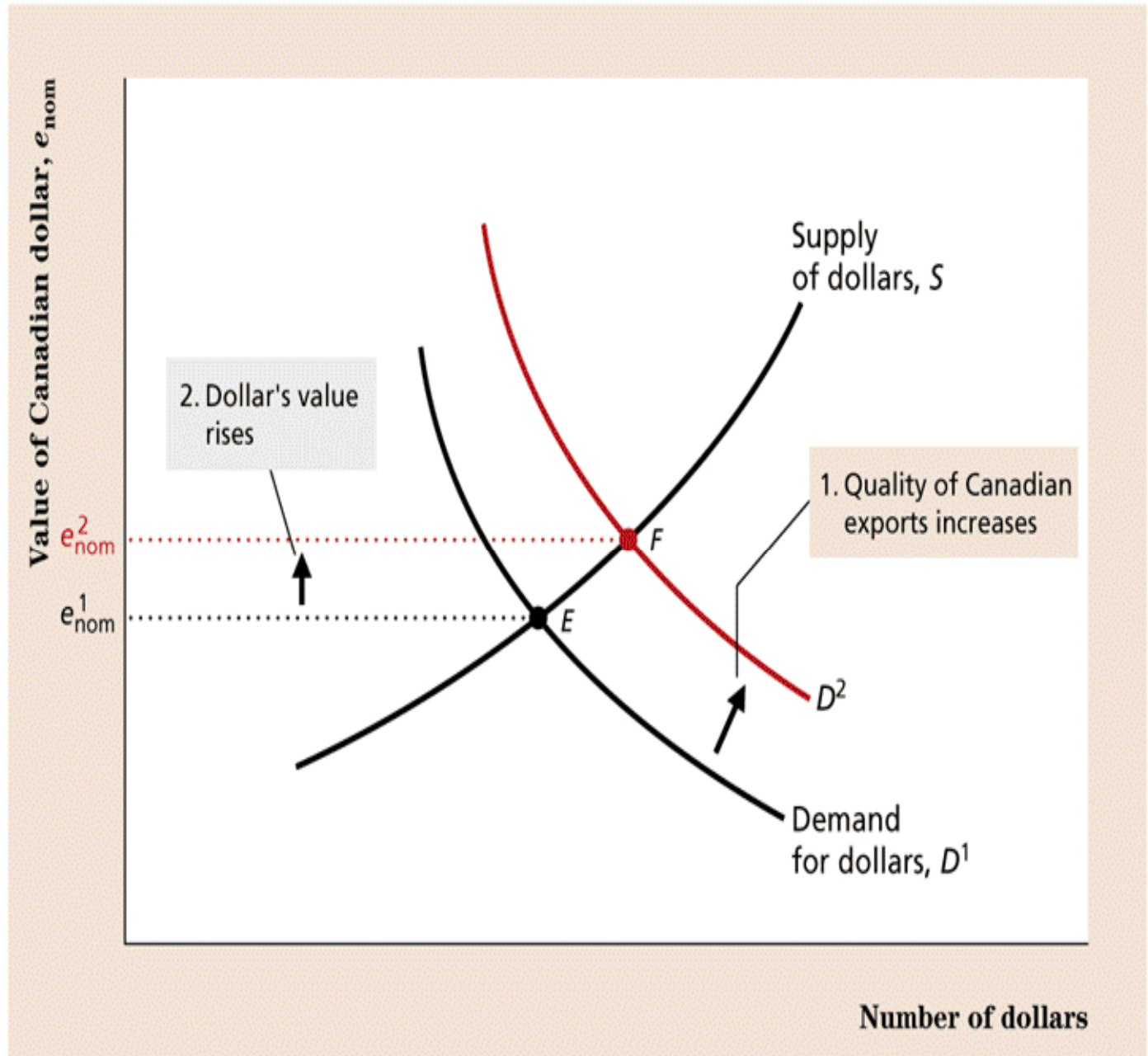
How Exchange Rates are Determined

- **Supply of dollars:** (upward sloping)
Why supply?
 - (i) buy foreign goods and services
 - (ii) buy foreign financial assets
- **Demand for dollars:** (downward sloping)
Why demand?
 - (i) buy Canadian goods and services
 - (ii) buy Canadian financial assets

FIGURE 10.3

THE EFFECT OF INCREASED EXPORT QUALITY ON THE VALUE OF THE DOLLAR

An increase in the quality of Canadian exports raises foreigners' demands for Canadian goods and, hence, their demand for Canadian dollars, which are needed to buy Canadian goods. The demand curve for dollars shifts, from D^1 to D^2 , raising the value of the dollar (the nominal exchange rate) from e_{nom}^1 to e_{nom}^2 .



Macroeconomic Determinants of the Exchange Rate and Net Export

- The goal is to build an *IS-LM* model for an open economy
- Remember that it relates Y and r
- Now we have also e and NX

Macroeconomic Determinants of the Exchange Rate and Net Export

1. When **domestic** output (income) rises the demand for imports increases and net exports fall.
 - The domestic currency **depreciates**, the exchange rate falls.
 - When Y increases, there is an increase in M demand (NX decreases because of a *direct* effect)
 - Sell CAD\$ to get foreign currency, i.e. the Supply of CAD\$ increases.
 - A depreciation of the exchange rate e_{nom} follows.

Macroeconomic Determinants of the Exchange Rate and Net Export

1. When **domestic** output (income) rises the demand for imports increases and net exports fall.
 - The domestic currency **depreciates**, the exchange rate falls.
2. When **foreign** output (income) rises exports increase and net exports rise.
 - The domestic currency **appreciates**, the exchange rate rises.

Macroeconomic Determinants of the Exchange Rate and Net Export

- If the **domestic** country's real interest rate rises, the country's real and financial assets are more attractive for investment.
- The demand for domestic currency increases and the exchange rate appreciates (e_{nom} rises).
- After the domestic real interest rate rises the exchange rate appreciation reduces net exports. (NX decreases because of a *indirect* effect)

Macroeconomic Determinants of the Exchange Rate and Net Export

- Say Canadian r rises
 - Canadian assets become more attractive
 - Demand for CAD\$ rises, e_{nom} rises
 - there is no direct effect on NX , but there is an indirect one: when e_{nom} rises, NX falls
- Say r_{For} rises
 - CAD\$ supplied to buy foreign assets
 - e_{nom} falls and NX rises indirectly

The International Asset Market

- In an open economy, savers have an opportunity to buy financial assets sold by foreign borrowers as well as those sold by domestic borrowers.
- Investment decisions depend on:
 - nominal interest rates.
 - expected changes to the exchange rate.
- International asset markets give a particular relationship between interest rates and exchange rates

Returns on Domestic and Foreign Assets

Example:

- A Canadian saver has \$100 to invest either in Canadian bonds or US bonds. Canadian bonds pay interest $i = 3\%$; US bonds pay interest $i_{\text{For}} = 6\%$.
- Assume the two assets have the same risk of default and liquidity. Which bond should we buy?

Returns on Domestic and Foreign Assets

- The US bond carries an additional potential return (gain/loss) because we need to purchase USD.
- Assume that the current nominal Can-US exchange rate is $e_{nom} = 0.8$.
- Before the pay-out next year, you (like others) expect the USD to depreciate (CAD will appreciate), so $e_{nom}^f = 0.85$.
- Option 1) Canadian investment \$100 CAD: \$103 CAD next year.

Returns on Domestic and Foreign Assets

- Option 2) US investment \$100 CAD
 - i) Convert to USD get $e_{nom} = 80$ USD
 - ii) Invest and get interest next year
$$= (1 + i_{For})e_{nom}$$
$$= (1+.06)80 = \$84.80 \text{ USD}$$
 - iii) Convert USD back to CAD.
$$= (1 + i_{For})e_{nom}/e_{nom}^f$$
$$=\$84.8\text{USD}/ 0.85 = \$99.76 \text{ CAD}$$(investment earns 6%, holding USD losses 6.25%)

General steps to calculate the gross nominal rate of return on foreign asset

- Step 1: Convert home currency to foreign currency.
- Step 2: Earn interest on foreign asset.
- Step 3: Convert foreign currency to home currency.

- Expected gross nominal rate of return on foreign asset = $(1 + i_{\text{For}}) \frac{e_{\text{nom}}}{e_{\text{nom}}}$

(Nominal) Interest Rate Parity

- Why would gross nominal rates of return differ in a free and competitive market?
- Arbitrage should make them equal
 - an explicit equilibrium condition summarizes this concept
 - it's called nominal interest rate parity

Interest Rate Parity

- Taking the exchange rates e_{nom} and e_{nom}^f as given, the interest rates, i and i_{For} , will adjust until the expected return for two similar investment options are equal. (No-Arbitrage condition)

$$\frac{e_{nom}}{e_{nom}^f} (1 + i_{For}) = 1 + i$$

- Same condition for real interest rate parity but r in place of i , e and e^f in place of e_{nom} and e_{nom}^f

$$\frac{e}{e^f} (1 + r_{For}) = 1 + r$$

Interest Rate Parity

- The difference in returns cannot persist for long, the nominal interest rates equalize.
- If the nominal (real) exchange rate is expected to remain the same as its current value, the nominal interest rate parity condition is

$$i = i_{For}$$
$$(r = r_{For})$$